W-15-R Surveys and Inventories: Evaluation

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The State of Nebraska is blessed with over 500 species of mammals, birds, reptiles and amphibians. The authority to manage these wild species has been given to the Nebraska Game and Parks Commission (NGPC) by the Nebraska Legislature. To properly manage these resources, the NGPC must have available a large, detailed, and up-to-date database on the population sizes, distribution, trends, demography, ecology, and habitat requirements of these species. W-15-R funding for surveys and inventories has been absolutely critical to building and maintaining this database.

The following grant evaluation is divided into several sections:
1. Big Game (mule and white-tailed deer, pronghorn, elk, bighorn sheep, wild turkey)
2. Upland Game (ring-necked pheasant, sharp-tailed grouse, greater prairie-chicken, northern bobwhite, cottontails, tree squirrels, mourning dove, and several less common webless migratory game birds)
3. Waterfowl (18 species of ducks, 5 species of geese, and coots)
4. Furbearers (muskrat, beaver, mink, raccoon, coyote, bobcat, and other mammals)
5. Threatened, Endangered, and Natural Heritage Program Species (black-tailed prairie dog, whooping crane, bald eagle, least tern, piping plover, mountain plover, and database management)
6. Wildlife Mortality, Diseases, and Parasites

Big Game

Methodology

Mule deer survey

A mule deer age and sex classification survey is conducted in Districts 1, 2 and 4 each year. Wintering areas of mule deer are located and surveyed to age/sex classify mule deer herds December 1 through February 15. Areas selected for mule deer classification have a history of wintering mule deer and are observable by the use of a spotting scopes or binoculars. District Managers assign personnel skilled in identifying mule deer bucks, does, and fawns. District Managers determine the general locations in the management units to make observations such that the number of observations is maximized with available time and personnel.

Sample size goals are 300-400 mule deer in each management unit, however observation goals are adjusted as is statistically necessary. When possible, simultaneous counts are made by 2 or more observers to classify the wintering mule deer herds at least twice to cross check accuracy of buck/doe/fawn classification and to compare temporal variation in counts. Both daylight and spotlight counts are used. GPS coordinates are recorded for each area observed and counted.

Turkey survey

Turkey management has evolved from initial introductions to small management units with limited permits to unlimited permits statewide. The old system of turkey brood routes and random observations used to track productivity was developed based on an expanding turkey population and the creation of different management units.

Now that turkeys are distributed across the state it was felt that a new approach was necessary to evaluate turkey productivity. General turkey distribution and relative abundance are now determined using the rural mail carrier survey, and a productivity survey was created based on turkey habitat regions within the six NGPC management districts. A district may have 1 or more regions. Random observations of toms, hens and poults are obtained during July 1 – August 31 in each region and productivity estimates are based on poult:hen ratios. Observers are asked to record the starting and ending odometer readings for each counting effort, and to continue surveys until they have observed 200-300 hens and young in a region.

Elk survey

The objective of the elk survey is to obtain information on population levels and age and sex of elk in occupied range across Nebraska.

A Bell 206 B-3 Helicopter equipped with a Gateway M275 touch screen laptop computer, Garmin GPSmap 196 and Arcview 3.2 software with real time tracking is used to fly and map routes in February of the best elk habitat of the Hat Creek and Bordeaux Management Units. Observers record the age, sex, and GPS location of all elk on route.

Pronghorn Aerial Survey

To obtain information on population estimates and productivity of pronghorns in occupied range across Nebraska. Aerial transects were flown in the North Sioux, Box Butte and Banner Management Units to locate and classify pronghorns to age and sex.

All transects were flown in a Cessna 205, with two observers and a pilot. Data are entered on a laptop computer using Minnesota's DNR Garmin real-time tracking program and DNR Survey ArcView extension. Data backup is done manually with a GPS unit, pen and paper. Distance between transects and transect length is described below. The survey is performed August. When observers locate a group the pilot steers off course and circles the group until a complete count is obtained, and the location marked. After data are recorded the pilot returns to and continues along transect.

North Sioux Unit
Transects: 12 transects-1 minute intervals from 103°35'W to 103°46'W (Roundtop-Bob Jordan Ranch) from the ridge to SD border (43°00'N). Surveyed approximately 160 square miles in North Sioux Unit.

Box Butte West Unit
Transects: 15 transects-1 minute intervals from 103°44'W to 103°49'W and 103°53'W to 104°01'W. North Boundary-White River Valley on east, Hwy 20 on west end. Southern Boundary- Foothills north of Platter River valley. Surveyed approximately 503 square miles in Box Butte West Unit.

Banner Units
Pumpkin Creek: 6 transects-1 minute intervals, flying east-west, from 41°39'N to 41°35'N from Hwy 71 to WY border. 19.5 mile transects-Approximately 117 square miles surveyed in Banner North Unit.

East of Kimball: 6 transects-1minute intervals from 103°33'W to 103°38'W from CO border (41°00'N) north to top of ridge north of 17 Mile Road. Surveyed approximately 138 square miles in Banner North and 112 square miles in Banner South.

West of Kimball: 7 transects-1 minute intervals from 103°42'W to 103°48'W from CO border (41°00'N) north to top of ridge north of 17 Mile Road. Surveyed approximately 148 square miles in Banner North and 105 square miles in Banner South.

Bighorn Sheep Observations

Observers determine the distribution, age and sex composition and minimum population of the Fort Robinson, Wildcat Hills and Barrel Butte herds by utilizing radio-collared animals. Trained observers locate individual collared animals and record location and population demographic information. They also record sightings of un-collared animals in the vicinity. Observers also make note of the general health and appearance of the sheep.

Harvest Surveys

Information on the harvest of deer, pronghorn, elk, and bighorn sheep is obtained through the use of compulsory check stations. Stations are established at strategic points and all successful hunters are required to present their animal(s) to an official check station. Trained personnel operate key check stations during peak periods to obtain biological information from the animals harvested. Deer and pronghorns are aged by dental eruption and wear (Severinghaus 1949, Robinette et al. 1957, Dow and Wright 1962), elk by cementum annuli through courtesy of Les Rice, South Dakota Game, Fish and Parks, and bighorn sheep by horn segment counts (Geist 1966). Beginning in 2004 elk were aged by dental eruption and wear (Jensen 1999).

Local personnel are employed to operate additional check stations, and are instructed on checking procedure and the information to record for each animal. All check station operators affix seals to animals checked, cancel permits, and record the species, sex, age, location of kill, days hunted, and date of kill. Check stations provide the opportunity to collect blood samples (currently obtained on all elk) and to examine animals or obtain samples periodically for disease (e.g. CWD, EHD/BTV).

Turkey harvest data were obtained through a questionnaire that was mailed to 500 current permit buyers in each of the spring and fall hunting units (3000 questionnaires in total). Those who did not respond to the first mailing receive a second questionnaire. The hunting success of nonrespondents is estimated to be 0.789 times that of respondents. Similarly, the proportion of permit buyers who did not hunt is estimated to be 1.709 times as great for nonrespondents as for respondents. Both of these rates are based on prior results from multiple mailings. Sex and age composition are obtained from breast and wing feathers, which are returned in postage paid envelopes provided with permits.

In 2006, harvest was also estimated through the use of an email survey sent to 12,805 permit buyers of spring permits. Reminders were sent to those who didn't respond in the two weeks. Response rate was 40%. Results were compared with the traditional mail survey.

Necessity

Population monitoring of big game species provides the demographic information necessary for biologists to manage big game species and the habitats in which they live. Excessive big game numbers can easily result in conflicts with the social and economic tolerance of landowners. Information collected through observational surveys is incorporated into decisions regarding hunting and habitat management in order to balance species populations with social interests.

Adequacy

Population surveys

Deer - Observations recorded indicate this survey provides a quality estimate of production for Nebraska's western mule deer populations. Observers feel strongly that they are able to correctly classify the age and sex of a high percentage of deer on the wintering grounds. Both the buck:doe and fawn:doe ratios obtained appeared reasonable for a wintering mule deer population.

Pronghorn - Aerial transects in the North Sioux , Box Butte and Banner Management Units cover approximately 3,323 square kilometers of good habitat in August. These transects provide population estimates and buck:doe:ratios for much of the major pronghorn range. These data are an essential complement to pronghorn harvest data in managing hunting of the species.

Turkey - Observers logged 5,395 miles and recorded 5,687 turkeys in 2006 through some of the best turkey habitat statewide. The quantity of these observations is enough to detect a 5% change in production in most regions across the state. This information is felt to be adequate to track changes in turkey populations across the state.

Bighorn Sheep - Radio telemetry based observations of bighorn sheep allows observers to construct populations by age and sex for each separate population, while keeping close track of the health of the sheep. It is also the basis for the current bighorn research being conducted in the state.

Elk – The winter aerial survey proved that elk could be located by helicopter with minimal to non-existent snow cover. The counts give biologists demographic information that can be compared from year to year from which management recommendations may be made regarding hunting and depredation work.

Harvest surveys

Data are adequate to recognize population trends for all species. With compulsory check stations for ungulates there is a virtually complete record of harvest. Accurate population composition information is obtained for about 25% of the firearm deer

harvest and these data can be used to adjust records from temporary check station operators. Turkey harvest data obtained from mail surveys provide results that are likely to be within about 5% overall of actual harvest and within about 10% on a unit basis (in years when units were employed). Age data are sufficient for the spring season and generally inadequate for fall. Results from the 2006 spring turkey email survey gave higher estimates of success than the traditional mail survey (64% vs. 56%), but over the long term should provide accurate trend data.

Reliability

Observations of bighorn sheep using radio telemetry equipment and mule deer on wintering grounds are highly reliable. Aerial transects using fixed wing aircraft to observe pronghorn in August provide reliable results for a minimum count leading to a population estimate. Observers were confident in age and sex classification at this time. Helicopter counts for elk have yet to be determined for reliability. Lack of snow cover, closed coniferous canopy and low population densities all add significant challenges for the technique. However, the number of elk observed on transect is promising. The turkey population survey is precise enough to detect small changes in production and provide biologists with reliable population information.

Harvest data are considered sufficiently reliable to form the primary base for formulating season recommendations. Although age (fawn or adult) is frequently recorded incorrectly by temporary check station operators, ratios are normally sufficiently close that correction is not required. A common error is in recording fawns as adults. Since the number of adult bucks is used as an indicator of population status, fawn bucks recorded as adult bucks will inflate that indicator. An estimate of correct numbers can be obtained by comparing information to that obtained by trained personnel. Further checks can be made by examining the number recorded as adult bucks (normally about 5% for whitetails and 2% for mule deer) on antlerless-only permits. Age composition based on the eruption and wear of mandibular teeth can be in error (Hamlin et al. 2000), particularly if personnel are not adequately trained. However, 1.5 year-old deer can be aged with a high degree of accuracy, and this proportion of the total adult bucks is used to indicate the relative harvest rate of bucks.

Efficiency

Deer – Mule deer observations on the wintering ground utilize the deer's herding behavior to maximize effort and reduce cost. Grounds are easily mapped and observed producing reliable low cost results.

Pronghorn - Fixed wing aerial transects cover range with the highest pronghorn density in the least amount of time. August allows the differentiation of fawns when viewing conditions are optimal.

Turkey – Vehicle routes conducted in July and August through the best habitat provide the greatest number of observations of hens with poults. The survey's long time period allows it to be conducted under optimal conditions.

Bighorn Sheep - Bighorn sheep habitat is very steep rocky terrain. The secretive nature of the species makes it hard to observe them. Radio telemetry equipment is necessary to locate them to record population demographic information. Using this equipment is the most efficient and reliable way to survey bighorn sheep.

Elk - Utilizing helicopters to fly GPS-directed transects is the recommended method for surveying elk in the western United States.

Harvest Surveys - The major out-of-pocket costs associated with surveys involve mandatory big game check stations. With this system it is necessary to pay temporary check station operators and to provide travel, lodging, and meals for personnel assigned to obtain biological data. It is frequently necessary to assign more personnel in some units than would be required for adequate data samples because of the inability of temporary operators to handle the hunter volume. Associated expenses for permanent personnel may exceed costs saved from not having to pay temporary operators, and salaries involved are higher for permanent personnel. However, this is essentially unavoidable if the current system is to be maintained. If response bias could be corrected, use of a voluntary report card system could provide sufficiently accurate estimates of total harvest. However, based on past experience, this would not provide accurate composition data on species, sex, and the age of harvested animals. Prior requests for incisor submission, which allows species and age determination, resulted in return rates, for each year in succession, as follows: 30.7%; 18.6; 20.9; 16.3; 9.9; 6.4; 9.2; and 6.1%. Later samples were inadequate. Further, the time delay involved in mail surveys would not be compatible with the current timing for formulating the next season's harvest recommendations. Use of a voluntary report card system would result in more conservative recommendations to safeguard the resources, which could result in greater problems with the social and economic tolerance of landowners.

Conclusions and Recommendations

Surveys currently being performed produce results that are necessary, generally reliable, adequate, and cost efficient to insure the proper management of the species. Methodology should be frequently reviewed and updated as new or revised techniques become available. It is recommended to continue these surveys through out the next evaluation period.

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UPLAND GAME

Rural Mail Carrier Survey (RMCS)

Data from this survey are used in Pheasant Population Surveys, Pre-season Inventory of Bobwhite Quail, and Cottontail and Squirrel Population Inventories and Harvest.

Methods

Survey cards are mailed to each of Nebraska's rural mail carriers, who are asked to record selected wildlife observations (generally, the numbers of ring-necked pheasant, northern bobwhite, prairie grouse, cottontails, and jackrabbits seen) made while running their normal mail routes on four consecutive days. Daily mileage and principal county traveled are also recorded. These data are then tabulated to produce a population index (animals observed per 100 miles driven) for each species of interest; indices are produced by county, by region, and statewide. Surveys are conducted during April, July, and October each year.

Necessity

Although our standard hunting seasons are appropriate for a wide variety of game population levels, severe winter weather conditions sometimes reduce populations to the extent that some reduction in harvest may be appropriate. The April and July surveys provide the only data available to determine the magnitude of population change following such winters prior to the setting of resident upland game hunting seasons by the Board of Commissioners in mid-July. Further, the RMCS provides the most extensive long-term data set describing population trends of upland game species in Nebraska. Managers wishing to ascertain changes in upland game populations since the 1950s rely on RMCS results to address these hypotheses.

Adequacy and Reliability

Abundance indices derived from the April and July RMCS are sufficiently sensitive to indicate moderate to large (>30%) changes in populations from year to year. Thus, they are adequate to signal when managers should consider changes to standard upland game hunting seasons following catastrophic winter losses. However, long-term changes in rural mail routes have likely introduced biases into the data set that managers must account for when testing hypotheses regarding population changes over time. For example, the number of miles driven per carrier has nearly doubled since the survey began in the 1950s, thus more of the survey miles in recent years tend to be run later in the day when upland game species are less likely to be observed. This and other biases do not render RMCS results unusable, but managers must be cautious when interpreting long-term trends.

Efficiency

The RMCS is highly cost efficient. The labor involved in collecting the observational data is provided essentially free-of-charge by the rural mail carriers. Compared to the

potential replacement cost of this source of labor, the costs of postage, materials, data entry, and analyses assumed by the agency are minimal.

Conclusions and Recommendations

This survey should be continued. Although time-related biases exist in the data, RMCS results and harvest statistics remain the only datasets available to test hypotheses regarding long-term trends in upland game abundance. The August Roadside Survey, which was initiated in 1995, may one day replace the RMCS in this role, but the RMCS should undoubtedly be continued in the meantime.

August Roadside Survey (ARS)

Data from this survey are used in Pheasant Population Surveys, Pre-season Inventory of Bobwhite Quail, and Cottontail and Squirrel Population Inventories and Harvest.

Methods

Eighty-three 30-mile routes throughout the State are driven once per year during 1-15 August, and observations of upland game species and numbers are recorded. Routes, which were originally located with a spatially-stratified random process, are run by NGPC personnel under standardized starting times, driving speeds, and weather conditions. When upland game bird broods are encountered, the ages of chicks are also estimated. The ARS was initiated in 1995.

Necessity

Along with the RMCS, the ARS provides an index of pheasant productivity and summer population size, which is necessary to accurately forecast fall population sizes and potential hunting opportunities. This information is requested with great frequency by the hunting public and national, state, and local media outlets. As annual survey results accumulate, they will also be used to detect the long-term trends in game abundance needed by decision-makers to formulate appropriate harvest strategies. Further, because many states collect similar information, these data allow managers to examine regional trends in upland game productivity to identify potential limiting factors at large spatial scales (e.g., see Riley and Riley 1999).

Adequacy and Reliability

August roadside counts elsewhere have been found to be good predictors of fall pheasant harvest levels (Wooley et al. 1978). However, the ARS currently has relatively low power to detect small to moderate changes in populations between years. Over the period 2001 through 2006, the minimum detectable difference for the statewide pheasant indices averaged approximately 30% with $\alpha = 0.10$ and power $(1-\beta) = 75\%$ (Zar 1996:135). Power to detect changes in pheasant populations could be improved by adding routes in the primary pheasant range; this would also likely improve power to detect changes in cottontail numbers. Numbers of observations of other

upland game species are generally too small to provide reliable indicators of most annual population changes.

The ARS is conducted under more rigidly standardized conditions than the RMCS, so the ARS should provide a more reliable long-term index of abundance than the RMCS. However, because the ARS was only initiated in 1995, it remains to be seen how well its results track long-term hunter success and population levels. The ARS undoubtedly provides more reliable information about pheasant productivity than the now-defunct incidental brood survey, which the ARS replaced in 1995. However, because we cannot estimate detection probabilities with current ARS methodologies, we cannot correct estimates of abundance for biases resulting from variable detectability.

Efficiency

Data for individual routes are collected as efficiently as possible given survey protocols. However, some routes have thus far provided few or no observations of upland game, so they could likely be run only every 2-3 years to increase efficiency without sacrificing data quality or the spatial coverage of the survey.

Conclusions and Recommendations

This survey should be continued. The ARS is probably the best spatially designed survey of upland game populations that we conduct, and its results provide valuable information that decision-makers use to predict relative hunting conditions, formulate harvest strategies, and detect long-term population trends. Efficiency and reliability could be improved by running some of the less "productive" routes (in terms of upland game observations) every 2-3 years instead of annually. Also, new routes should be added in regions that have high to moderate pheasant populations in order to improve detection of small to moderate annual changes in area-specific pheasant abundance, and to better predict changes in hunting quality in areas that receive the most hunting pressure.

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Prairie Grouse Breeding Ground Survey

Methods

Twenty-one 19-mile routes within Nebraska's prairie grouse range are currently surveyed annually during 1-20 April, in a fashion similar to that described by Horak (1985). Starting 45 minutes before sunrise, under low wind conditions, observers first run a listening survey, stopping every mile along the route (20 stops per route) and recording the approximate locations of actively displaying prairie grouse males that can be heard from the road. On a subsequent morning, observers then locate the display grounds (leks) they previously heard, as well as leks located in previous years that may not have been heard during the listening run. After locating leks, observers count the number of greater prairie-chickens and/or sharp-tailed grouse present on each. Only leks within 1 mile of the survey route are recorded. The estimated number of males present at each lek is then calculated using an assumed sex ratio, which is based on the average sex ratio of grouse present on leks during the survey period as determined by historic observational data. The estimated number of males present on each survey route is then used as the index of population size in the Sandhills region (for prairie chickens and sharp-tailed grouse separately) and the southern region (for prairie chickens on routes south of the Platte River).

Necessity

This survey provides the best means for managers to track changes in the distribution and abundance of breeding prairie grouse. Given the high national profile of prairie grouse as indicators of grassland ecosystem health, the data generated by this survey are invaluable to managers wishing to link grouse population trends with land use change over time.

Adequacy and Reliability

This survey has historically been run under rigorously controlled conditions, so it should provide a relatively unbiased index of long-term population change at the route, region, and statewide scales for both species. However, because detection probabilities were not estimable, estimates of relative abundance will be biased to some unknown extent. Further, the reliability of detecting year-to-year population changes varies by species and region. Prairie chickens in the Sandhills are generally observed on 12 routes, and based on data obtained between 2000 and 2006, inclusive, the minimum detectable difference in male population size averaged 72% with $\alpha = 0.10$ and power $(1-\beta) = 75\%$ (Zar 1996:135). Likewise, for sharptails in the Sandhills over the same time period (usually present on 8 routes), the minimum detectable difference averaged 89%. In the southern region, minimum detectable difference for prairie chickens 62.5%. Based on these calculations, our ability to detect annual changes in regional prairie chicken abundance is fair to good, but it is poor for sharptails.

Efficiency

Although time and labor intensive to conduct, this survey provides data that are more intimately tied to actual population levels than any of our other surveys. Given this high level of data quality, and the protocols necessary to provide that quality, individual routes are collected as efficiently as possible.

Conclusions and Recommendations

This survey should be continued. It provides managers with valuable information regarding long-term trends in grouse distribution and abundance, and allows examination of land use influences on grouse population dynamics. However, the ability of managers to detect annual changes in abundance could be improved by increasing the number of routes. If this strategy is adopted, creating new routes in areas dominated by sharptails should be emphasized.

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Prairie Grouse Hunter Check Station and Hunter Cooperator Survey

Data from this survey are used in the Collection and Analysis of Grouse Harvest Data.

Methods

Prior to the grouse hunting season, wing envelopes are sent to about 150 “avid” grouse hunters, who are asked to return one wing from each harvested grouse and provide information about their grouse hunting activities throughout the season. Species (sharp-tailed grouse or greater prairie-chicken) and age (juvenile or adult) are then ascertained from submitted wings, and hunter success is calculated. Additionally, courtesy (i.e. non-mandatory) hunter check stations are manned by agency personnel at 8 locations during the opening weekend of the grouse season, and at one large privately organized hunt (generally 100 hunters) during the second Saturday of the season. Species and age are ascertained for harvested grouse, and hunter effort and success are recorded.

Necessity

Prairie grouse are not often observed on our spring and summer roadside surveys, so reliable information about grouse productivity is unavailable prior to the hunting season. Age ratio information collected during the hunting season is thus the only means by which grouse productivity is currently monitored; trends in productivity are important to managers wishing to understand the basic causes of changes in population size over time. Data from hunter cooperators also allow managers to track changes in hunting success and behavior over time by individual hunters, which is not possible with the general small game harvest survey (i.e. the Hunter Success Survey) we conduct. Additionally, information regarding hunter success on opening weekend is sought by hunters, staff, and media wanting to predict hunting conditions during the remainder of the season.

Adequacy and Reliability

In total, this survey allows staff to examine on average 325 grouse wings/hunting season. This sample thus represents on average 1% of the grouse harvested statewide, which provides age-ratio information to track long-term trends in grouse productivity.

The use of opening-weekend check stations has declined in recent years. Historically, these check stations recorded more than 700 hunter-days of effort, thus yielding information adequate to provide preliminary hunting success information to the State's approximately 6000 grouse hunters. Based on check station data from the 2000 through 2002 seasons, an average of 800 hunter-days were recorded.

Sample sizes, and thus reliability, vary from year to year, particularly for the birds examined at the hunter check stations. Poor weather during the opening weekend reduces hunter effort, which in turn reduces the number of hunters checked by station personnel and thus diminishes the reliability of reported hunter success as a predictor of hunting conditions during the remainder of the season. Because this is largely a weather-related relationship, it is difficult to envision a particular change in methodology (e.g. increases in the number of stations) that could overcome this problem without greatly increasing the cost of this portion of the survey.

For detecting year-to-year changes in the percent of juveniles in the harvested sample, a minimum annual sample size of 660 wings is necessary to detect a 5% change with $\alpha = 0.10$ and power $(1 - \beta) = 75\%$ (Zar 1984:399). Samples are currently insufficient to detect changes of this magnitude. Efforts are currently being developed to increase hunter participation in wing surveys.

Efficiency

The hunter cooperator portion of this survey is conducted with a minimum of personnel time and postage costs, and thus provides data very efficiently. The hunter check station portion of the survey, however, requires at least 17 man-days of labor each season to collect data, so it is somewhat less efficient. However, there appears to be no other way to collect harvest data from a large number of hunters over an extensive geographic area and still be able to compile those data within 3-4 days of the opening day of the season. Given these constraints, data from hunter check stations are collected as efficiently as possible.

Conclusions and Recommendations

This survey should be continued. It provides the only feasible means by which data regarding grouse productivity can be collected. It also remains the most efficient way to provide early season hunting success information to interested hunters, management staff, and media outlets.

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Northern Bobwhite Whistle Count Survey

Data from this survey are used in the Pre-season Inventory of Bobwhite Quail.

Methods

Forty-one 19-mile survey routes are run within the State's primary quail range each year between 16 June and 10 July. Beginning at sunrise, observers stop every mile along their routes (20 stops per route) and count the number of quail they hear giving the "bob-white" call. Routes are run under low wind conditions and with a temperature at the beginning of the route of less than 70 ˚F. Stops at which traffic noise or other disturbances may have significantly altered the observer's ability to detect quail are not used in analyses. Annual indices for each route are summarized as the average number of males heard per stop.

Necessity

Along with the April and July Rural Mail Carrier Surveys, the whistle count survey provides information regarding population status prior to the setting of hunting seasons at the July Board of Commissioners meeting. Whistle counts are the only quail-specific survey we conduct, and their results are likely more sensitive to population changes than are the general roadside surveys. Site-specific whistle count data can also be used to test hypotheses regarding relationships between land use (from local to landscape spatial scales) and population levels.

Adequacy and Reliability

Controversy exists regarding the efficacy of whistle counts in predicting fall population levels (Curtis et al. 1989). However, they have been identified as an appropriate tool for detecting long-term changes in population levels and relative densities (Stauffer 1993). Managers should therefore be cautious when using results to forecast upcoming hunting conditions, but should have confidence in the survey's ability to retrospectively detect population trends and identify regional differences in abundance. Regarding the survey's precision in detecting year-to-year changes in whistling males per stop, using data covering 2000 through 2006, the minimum detectable difference for the statewide index was 24%, with $\alpha = 0.10$ and power $(1-\beta) = 75\%$ (Zar 1996: 135). As with other "convenience" surveys, the lack of an estimable detection probability introduces bias in the abundance index.

Efficiency

Like all route-based surveys, whistle counts are moderately expensive in terms personnel time and vehicle mileage. However, data for individual routes are collected as efficiently as possible given survey protocols.

Conclusions and Recommendations

This survey should be continued. Whistle count results are appropriate indicators of long-term population change and relative density, which provide the information necessary for managers to make decisions regarding optimal harvest and habitat management strategies.

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Northern Bobwhite Hunter Cooperator Survey

Data from this survey are used in the Collection and Analysis of Quail Harvest Data.

Methods

Prior to the quail hunting season, wing envelopes are sent to about 80 “avid” quail hunters, who are asked to return one wing from each harvested quail and provide information about their quail hunting activities throughout the season. Age (juvenile or adult) ratios are then ascertained from submitted wings, and hunter success is calculated.

Necessity

Bobwhite are typically not observed in large numbers on our spring and summer roadside surveys, so reliable information about quail productivity is unavailable prior to the hunting season. Age ratio information collected during the hunting season is thus the only means by which quail productivity is currently monitored; trends in productivity are important to managers wishing to understand the basic causes of changes in population size over time. Data from hunter cooperators also allow managers to track changes in hunting success and behavior over time by individual hunters, which is not possible with the general small game harvest survey (i.e., the Hunter Success Survey) we conduct.

Adequacy and Reliability

In total, this survey allows staff to examine an average of approximately 450 wings per hunting season (range: 180-803). This sample is <1% of the quail harvested statewide each year, but likely provides age ratio information precise enough to track long-term trends in quail productivity. For detecting year-to-year changes in percent juveniles in

the harvested sample, a minimum annual sample size of 660 wings is necessary to detect a 5% change with α = 0.10 and power (1 - β) = 75% (Zar 1984:399). Samples are, on average, insufficient to detect changes of this magnitude.

Efficiency

This survey requires a minimum of staff time and postage costs to conduct. It therefore remains a very efficient means of collecting information regarding quail productivity and the success of individual hunters.

Conclusions and Recommendations

This survey should be continued. Attrition in the number of participating cooperators over time has caused sample sizes to decline, so an effort should be made to recruit new participants to maintain or increase survey reliability.

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Mourning Dove Call-Count Survey

Data from this survey are used for the job: Cooperation in Central Management Unit.

Methods

Nebraska cooperates with the U.S. Fish and Wildlife Service in conducting the mourning dove call-count survey. Twenty-four call-count routes are surveyed annually in the State. A description of survey protocols, analyses, and results is provided by Dolton and Smith (1999). As per evaluation report guidelines for cooperative USFWS surveys, further evaluation of this survey will not be presented.

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Dolton, D. D., and G. W. Smith. 1999. Mourning dove breeding population status, 1999. U.S. Fish and Wildlife Service, Laurel, Maryland. 28 pp.

Collection of Harvest Data

Small game harvest surveys are an important part of game management. Harvest levels are indicative of population levels and reflect interest by our constituents. Hunter success surveys (HSS) have been used to estimate the harvest of small game in Nebraska for several decades. These data provide long-term harvest trends that reflect general population levels for most species of small game, including waterfowl. (See also Collection of Waterfowl Hunting Season Data below.)

Methodology

The hunter success survey (HSS) is conducted on an annual basis. This is a mail survey, sent to a random selection of approximately 9% of Nebraska's small game hunters. The name and address database is a compilation of traditional permit-book and on-line permit buyers. Potential respondents are drawn randomly from the compiled list, with the number of surveys allocated to each group (permit book or on-line) proportional to the total number of sales in each group. Hunters are asked to provide their estimates of harvest and effort for each species hunted. Also included are questions about the month and county of kill. Only one mailing is conducted annually.

Necessity

Harvest and effort information are used as a basis for determining the effects of season changes, changes in species abundance and hunter interest. This information is used in making recommendations for hunting seasons and management efforts.

Adequacy

The response rate for this survey has averaged 23% since the 2002-2003 season. Nonresponse bias has not been estimated. Memory bias also occurs when surveys of this type are conducted 6 months after the close of a season. While bias can have significant effects on estimates, it is expensive and time consuming to estimate. One of the main objectives of this survey is to provide long-term estimates of harvest and effort. While bias occurs, we believe that it has been fairly consistent across years and therefore allows us to have a reasonable estimate of statewide harvest trends over time. In this regard, the survey is successful.

Reliability

Aside from biases, which have been discussed, this survey is reliable for most "major" species, or those with total harvests exceeding 40,000. For those species that are harvested at low rates, this survey is of minimal value. Eleven species surveyed in 1998 had harvests exceeding 40,000, while six species had harvest estimates of less than 10,000. Five of these six species are migratory game birds and HIP will likely be used for these estimates in the near future.

Efficiency

This survey is cost effective. It provides information on eighteen species, is significantly less expensive than telephone surveys and HIP surveys, and is more reliable than volunteer hunter report cards.

Conclusions and Recommendations

We recommend the continuation of this survey. Name and address extraction from permit books should be done earlier if possible to reduce memory bias. It is recommended that nonrespondant reporting bias be evaluated for major species on a 5-year basis. The NGPC should investigate the possibility of using HIP registration name and address for some of the sample to reduce data entry costs.

WATERFOWL

Waterfowl Breeding Population and Production Surveys

Methodology

Determining the size of waterfowl breeding populations and annual production rates are accomplished using aerial and ground surveys. For breeding population information, a combination aerial-and-ground survey is conducted beginning in early May. A ground brood survey to measure production is conducted in July. Both breeding population and production surveys are conducted in the Sandhills of northcentral Nebraska. The Sandhills region is a major waterfowl production area and provides the best index of breeding waterfowl populations for the State.

Beginning in 1999, protocol for the aerial portion of the breeding population survey followed that of the Cooperative Breeding Waterfowl and Habitat Survey (CBWHS) conducted annually by the U.S. Fish and Wildlife Service (USFWS) and the Canadian Wildlife Service (CWS) in other portions of North America (USFWS 1987). Additionally, beginning in 2003, double observer methodology was employed to account for visibility bias (i.e. waterfowl and water areas present but not observed by aerial observers). The current protocol used in Nebraska differs from the CBWHS in that the CBWHS uses air-ground segments to correct for visibility biases (but see below).

Although the survey protocol prior to 1999 was similar to the CBWHS, there were differences that made comparisons to the CBWHS data difficult. These differences also precluded direct inclusion of information into the USFWS's fall flight indices. Changes made in survey protocol in 1999 included (1) a different aircraft used, which allowed both the pilot and an observer to count waterfowl, (2) using a Global Positioning System (GPS) to keep aircraft on designated transects, and (3) initiating the daily transects from the east and heading west. Initiating transects from east to west reduced the amount of sun glare relative to the previously used west to east headings. Also, water areas were redefined according to that used by the USFWS (1987) on the CBWHS. This included more of those areas that were considered "temporary" breeding habitat and not counted in previous years. Protocol changes will allow for more accurate counts of breeding waterfowl and water areas as well as provide a better basis for comparison with survey results from other areas of North America. A faster aircraft also improves the safety and efficiency of conducting the survey.

The ground portion of the breeding population survey is made throughout the Sandhills in order to determine species composition and to correct the aerial results. Three routes have been established and are conducted concurrently with the aerial portion. A single observer initiates the route from the starting point at sunrise and completes the route approximately by noon each day. As with the aerial portion, pairs, single drakes, flocked drakes and flocks of each waterfowl species on both sides of the route are

counted. The number of water areas is also recorded, but only from the right-hand side of the route.

Beginning in 2002, some ground surveys aligned with segments of the aerial portion of the survey were conducted to initiate estimates of visibility bias. As with the aerial portion, pairs, single drakes, flocked drakes and flocks of each waterfowl species on both sides of the route are counted. The number of water areas is also recorded on both sides of the route, and habitat characteristics of water areas also are recorded.

To index production, additional ground surveys are made throughout the Sandhills to obtain brood data. Similar to the ground portion of the breeding population survey, three routes have been established and the following data are collected: number and species of duck and goose broods, ducklings or goslings per brood, and the number of water areas (from the right-hand side of the route only). Broods are classified according to age class (Gollop and Marshall 1954). The species and number of any pairs, singles, and flocked ducks are also recorded.

Necessity

The Sandhills of Nebraska constitute a major waterfowl breeding area and contribute significantly to the fall flight of waterfowl in Nebraska and the Central Flyway. Assessing the population sizes and production for each species breeding in the region is important in determining the size of the fall flight of waterfowl from Nebraska. Breeding waterfowl population and production information also is used by other agencies, such as the USFWS, in predicting the fall flight of waterfowl on a continental basis. Thus, the breeding population and production surveys conducted are critical to proper waterfowl management, in terms of both harvest and habitat conservation, in Nebraska, the Central Flyway, and North America. Changes in the distribution of some species, such as the reintroduced trumpeter swan, also can be monitored.

These surveys additionally indicate trends in breeding population size or production attributable to changes in habitat quality and/or abundance, predator type and/or abundance, and other factors that limit waterfowl populations. Monitoring long-term, landscape level impacts on waterfowl populations provides a vital barometer for natural ecological change as well as land management practices in a state almost entirely composed of privately owned lands. The NGPC and other state agencies use these data to determine the potential impacts of human-induced habitat changes (e.g. for the preparation of Environmental Impact Statements). Non-governmental agencies, such as Ducks Unlimited, also may use this information to prioritize conservation efforts (Ducks Unlimited 1999).

Adequacy

Prior to 1999, the aerial survey probably was not accomplishing its intended purpose with great accuracy or precision. Additionally, population estimates were incomparable to numbers from the CBWHS. Since 1999, the aerial survey is accomplishing their

intended purposes. Ground surveys and July brood surveys are probably accomplishing their intended purposes. Year-to-year changes in waterfowl populations and production are well-monitored and management decisions to apply the proper harvest regime can be made in a timely fashion.

Reliability

Both the waterfowl breeding population survey and the July production survey are conducted at the appropriate time to capture the majority of breeding waterfowl and brood production in the State. Each survey does require certain elements to retain their reliability. First, problems associated with aerial surveys for breeding waterfowl have been discussed in Martin et al. (1979) and Cowardin and Blohm (1992), and this survey is subject to those biases. With the addition of double observer methodology, population estimates can be corrected for visibility biases. The air-ground segments also correct for visibility bias but are not conducted across the survey area. Secondly, however, the aerial portion of the survey was not conducted in 2006 due to lack of a trained pilot who has experience at flying low level and simultaneously observing and identifying ducks. Without a trained pilot the reliability of this survey is in question.

The July production survey also does not include methodology to estimate visibility biases. Additionally, comparisons between different areas of the Sandhills are not possible given transects are not segmented and specific pond locations are not recorded. While the surveys can reflect relative, annual changes in the breeding populations and production rates of waterfowl in the Sandhills, their accuracy and precision may not be great. But information from this survey can be used to make management decisions regarding harvest regulations. The survey does not cover the entire State, and some breeding waterfowl populations, such as Canada geese that nest statewide, are under-represented. Additional inventories are needed to assess these populations.

Efficiency

The design and methodology are probably the most cost efficient means to accomplish our objectives. The Sandhills region is an extensive area without many roads, so conducting as thorough a survey by vehicle would be impossible. Other methods to estimate populations (e.g., point counts, line transects) would require a large sample size for adequate precision. The logistics of initiating counts in areas without distinguishable landmarks as well as obtaining permission from multiple landowners would make surveys difficult to repeat annually. Thus, low-level aerial surveying is the most efficient means to accomplish these tasks at this time. The change in protocol and aircraft in 1999 also has increased the efficiency of this survey, but requires a trained pilot and an aircraft with sufficient power.

Conclusions and Recommendations

The breeding waterfowl population and production surveys should be continued. The Sandhills region is the most important breeding area for waterfowl south of the Prairie

Pothole Region (Bellrose 1980). The change in survey protocol in 1999 and inclusion of double observer methodology and air-ground segments have greatly enhanced the results. However, locating a trained and experienced pilot makes completion of this survey extremely difficult. The few individuals with this training are typically already employed with the USFWS and are preparing for the CBWHS. Evaluation and possible changes to the July production are needed. Correcting for visibility bias and more accurate data collection (e.g., pond locations) are needed to increase the accuracy and reliability of this survey. Because other waterfowl populations (e.g. Canada geese) nest in other areas of the State, aerial and/or ground surveys should be initiated to supplement information gained from the Sandhills survey. Additionally, this information would provide a clearer picture of Canada goose breeding distribution and abundance in Nebraska.

Waterfowl Banding

Methodology

This survey is designed to band representative samples from important waterfowl populations, and to analyze subsequent recoveries for information on population parameters, dispersal, and life history. Currently, banding activities have centered on Canada geese. Primary banding locations include the Panhandle portion of Nebraska and in Lancaster County near Lincoln, NE. Juvenile and molting Canada geese are herded by boats and personnel into a corral trap (Cooch 1953). Birds are then aged and sexed (Hochbaum 1942) and fitted with a USFWS legband and released at the trap site. Legband numbers from birds previously fitted with bands are recorded. The analysis of recoveries focuses on Canada geese banded in the Central Flyway and their relationship to Nebraska's goose harvest.

Necessity

The collection of band recovery information is important in managing Nebraska's Canada goose population because it is used to determine changes in the derivation and distribution of harvest, as well as to estimate survival rates and population sizes. Banding analysis requires several years of banding followed by several years of recoveries for proper evaluation (Brownie et al. 1985). Thus, band analyses are typically not conducted on an annual basis, but rather after initiation of a management action or other change that could affect goose populations (e.g. habitat alterations). However, banding programs must be in place and operating annually in order to be of use in management decisions when these changes occur. Additionally, special banding requirements, such as reward banding to determine reporting rates, are periodically needed.

Adequacy

The survey is accomplishing its intended purpose. Nebraska's banding program has been in operation over a sufficient number of years that it has the capacity to reveal important population and harvest changes.

Reliability

Possible changes in survival rates and the distribution of harvest can be made from banding efforts conducted thus far. Most of the models in Brownie et al. (1985) assume that multiple years of banding and recoveries are made to estimate survival. Banding of Canada geese in the Sandhills, Panhandle area and in eastern Nebraska have been conducted since 1990 or earlier. For example, from 1990-2000, 13,818 Canada geese (AHY males: 5,293, AHY females: 5,170, HY males: 1,522, HY females: 1,833) were banded in Nebraska (Powell et al. 2004). This number of banded geese is sufficient information regarding survival rates and the distribution of harvest to detect changes germane to possible management actions.

Efficiency

Capturing large numbers of geese can be accomplished by two methods: (1) herding and capturing molting birds in summer (Cooch 1953) or (2) baiting a site and using a rocket net (Dill and Thornsberry 1950). Herding and capturing molting geese is a relatively inexpensive technique, considering the number of geese captured for the human-power required. For example, at Branched Oak Lake in Lancaster County, Nebraska, in July 1999, 20 people captured 943 geese and processed all birds within four hours on a single day. Rocket netting requires preparation of a capture site, extended periods of baiting and watching the baited site. Attempting to capture the same number of birds at the same site by rocket netting would probably have taken several weeks. Capturing molting geese in summer has additional benefits in that large numbers of juvenile geese are banded on their natal grounds. These juveniles provide information on natal dispersal and they provide survival data for an age cohort that has different hunting vulnerability than subadult or adult birds.

Estimating movements, harvest dynamics and survival rates also can be determined by radio telemetry or the use of neck collars. Radio telemetry studies can provide a wealth of information on a number of different aspects of a wildlife population (White and Garrott 1990). Neck collar studies of geese have provided some important information on habitat use, movements, and demography (Ogilvie1978), but they tend to be expensive studies to conduct (Samuel and Fuller 1994). Nebraska has utilized neck collar observations in the past to look at movements of Canada geese around Lincoln, NE (Groepper et al., in prep,). However, neck collar work is significantly more expensive than banding because an observer network must be set up to collect information in addition to the initial marking effort.

Conclusions and Recommendations

Banding of Canada geese in Nebraska should be continued. Without band recovery information, proper management of Canada goose populations in Nebraska and the

Central Flyway would become more difficult. Also, considering the increase in the resident population of Canada geese in Nebraska, and the increase of complaints by property owners due to urban geese, continued banding will allow for the design and evaluation of management actions, such as early September hunting seasons. However, proper evaluation of management actions through banding analysis can only be conducted by having banding programs in place well in advance of the actions. The current program may require expansion to target growing Canada geese subpopulations in other parts of Nebraska. Expansion of the banding effort to include species that utilize migratory habitats in Nebraska (e.g. Rainwater Basin) would improve management of these species by identifying linkages between wintering, migration, and breeding habitats. In turn, these linkages could be vital for conservation planning efforts (Ducks Unlimited 1994).

Radio telemetry and neck collar studies may be needed in some cases when more detailed information is required on specific populations. For example, neck collar observation studies on the movements and distribution of Canada geese prior to, during, and after an early September season would be essential to evaluating the season and making any necessary management changes subsequently.

Waterfowl Population Movements

Methodology

This survey is designed to monitor the seasonal occurrence of each species in various areas of the state. The primary survey conducted in Nebraska is the Midwinter Waterfowl Inventory (MWI) usually performed in early January. The MWI is coordinated by the USFWS and is conducted annually. In Nebraska, 3 aerial crews are used to simultaneously survey areas with major concentrations of waterfowl. Surveyed areas include: the entire Main Platte, North and South Platte, and Main Loup Rivers; portions of the South, Middle, and North Loup, Missouri, Republican, Niobrara, and Snake Rivers; other small natural and man-made drainages; and the majority of large reservoirs and lakes. Additionally, ground counts are conducted by other NGPC personnel in areas not covered by aerial counts and in some areas also covered by aerial surveys. Counts are reconciled on those areas with both ground and aerial counts. Aircraft fly at 100-400' above ground level and the number and species of all waterfowl observed are recorded. One or two observers are in the plane, depending upon the pilot's experience and the area being surveyed. Aerial surveys are initiated at approximately 8:00 AM and terminated near 4:00 PM. Routes are flown generally from east to west at the start of the survey to reduce sun glare.

Necessity

The MWI is used to monitor the distribution of waterfowl, habitat conditions, and for regulatory considerations of selected populations. The MWI needs to be continued for several reasons: (1) it provides the only annual population data for several species of ducks, such as buffleheads, goldeneyes, and ruddy ducks; (2) it is the current official

survey used in the management plans for some Canada goose populations and for eastern population tundra swans - in the Central Flyway alone, 10 species plans depend on the MWI; (3) it is the official population survey used for mid-continent light goose populations. The survey needs to be maintained to monitor the success or failure of population reduction techniques now in use, or being contemplated for future use. Additionally, data collected from the MWI also can be used for assessing environmental impacts and developing mitigation proposals, provide information for legal actions, and support acquisition programs (Heusmann 1999). Information from the Nebraska MWI has been given to other agencies (e.g. USFWS) for their use and in most instances, the only information available on waterfowl use. Currently, no other surveys are conducted in Nebraska to obtain information similar to that of the MWI.

Adequacy

The results from the MWI, when combined with data collected from other states, have been used to set harvest regulations for Canada geese and other species. Most harvest regulations are predicated on a running three-year average, but the data are collected at the proper time for possible changes in harvest regulations the following year.

Reliability

Various sources of error associated with the MWI, including but not limited to changes in observers, routes, effort, weather, and habitat changes make comparisons among states and years untenable (Eggeman and Johnson 1989). More consistent efforts in survey methodology (i.e. same routes and effort) would reduce the amount of error. However, the MWI was never intended to produce complete counts or estimates, but rather total counts of specific species each year (Eggeman and Johnson 1989). Despite the annual variation, the MWI in other areas has detected gradual changes in populations that other, independent surveys also detected (Conroy et al. 1988). Thus, the MWI has been useful for population management. Nebraska's MWI has been relatively consistent in regards to routes flown, observers, and effort, although minor changes have occurred due to personnel turnover, shifts in waterfowl distribution, and weather. Trends in waterfowl populations from Nebraska's MWI seem to follow that of the Central Flyway results. For example, Canada geese in the Central Flyway have grown from an average of 786,767 geese from 1985-1989 to an average of 1,501,727 geese from 1995-99, an approximate increase >90% (Kruse 2006). Averages for the same time periods of counts in Nebraska at the time of the MWI have increased 80% (105,865 vs. 190,243). Thus, the MWI seems to be a reliable survey for detecting population changes in Nebraska.

Efficiency

The present methodology appears to be the most cost efficient means by which to gather this information. Improved methodology, based on better experimental design to make estimates statistically defensible (Conroy et al. 1988, Reinecke et al. 1992) probably can be accomplished. However, the increase in precision would not likely justify the increased costs. Maintaining the aerial portion of the survey is critical, as

increased staff time would be needed to cover those areas by ground or boat. Additionally, visibility would be limited in some locations and permission from private landowners would be required. Inconsistencies in access would make results more spurious than they are currently.

Conclusions and Recommendations

Nebraska's participation in the MWI should be continued. Nebraska's participation in the MWI is important for monitoring certain Canada goose populations and other waterfowl species that are not surveyed at other times (e.g. mergansers). Further, there have been no indications that other surveys will be initiated by other agencies to replace the MWI. MWI information has been useful for other agencies where waterfowl use data are needed. Improvements to ensure that routes, observers, and effort are standardized might be warranted.

However, there may be occasions where more precise surveys are required. For example, the number of light geese in the Rainwater Basin of Nebraska has increased since the early 1990's. This increase has led to conflicts between managing for other waterfowl species in this area and increasing harvest opportunities to reduce the population of light geese. Frequent, precise counts of light geese in this region are critical for understanding the effects of habitat management (e.g. pumping areas) and hunting.

Collection of Waterfowl Hunting Season Data

Methodology

The Hunter Success Survey (HSS) is conducted on an annual basis to provide long-term harvest trend data, which is reflective of general population levels for most species of small game and migratory game birds. Harvest levels also can indicate hunter interest and changes in hunter behavior. Specifically for Canada geese, the HSS is used also to estimate the level of harvest in the western counties of Nebraska. A portion of Canada geese harvested from this area are considered part of the Hi-Line Population (HLP) Canada geese; the management plan for the HLP calls for specific population objectives and monitored harvests (Central Flyway Council 1998). Another example is preference for hunting season dates within duck hunting zones.

The HSS is a mail survey, sent to a random selection of Nebraska's small game hunters. A database is created from the names and address of hunters who purchased small game licenses (all persons - resident and nonresident - who hunt migratory game birds are required to have a permit in their possession). Approximately 9% of these licensed hunters are randomly selected and send a survey. Hunters are asked to provide harvest numbers and effort for each species hunted, as well as information on the month and county of kill.

Necessity

Harvest and effort information are used to determine the effects of season changes, changes in species abundance, and hunter interest. This information is used in making recommendations for hunting seasons and related management efforts. This information also is used to assist in the management of HLP Canada geese.

Adequacy
See "Collection of Harvest Data" in the Upland Game section for a general discussion. Data are provided for county of kill, which is needed for management of HLP Canada geese.

Reliability
Harvest estimates from the HSS for some species (e.g. total ducks) are higher than those derived by the USFWS (Kruse 2006). Harvest estimates from USFWS are derived from the HIP Survey. Discrepancies may result from a more intensive survey in HSS, nonrespondent bias, and memory bias.

Efficiency
This survey is cost effective. It provides information on eighteen species specific to Nebraska, it is significantly less expensive than telephone surveys and HIP surveys, and it's more reliable than volunteer hunter report cards.

Conclusions and Recommendations
We recommend the continuation of this survey. Name and address extraction from permit books should be done earlier if possible to reduce memory bias. An increase of response rate would be desirable, as other hunter surveys have had higher response rates (Gray and Kaminski 1993). Also, it is recommended that nonrespondent reporting bias be evaluated (Gray and Kaminski 1993) for major species on a 5-year basis. The Agency should investigate the possibility of using HIP registration names and addresses for some of the sample to reduce data entry costs. Additionally, the Agency should investigate use of internet survey methodologies to reduce the number of paper surveys, send follow-up reminders, and increase response rate.

Comparisons of harvest estimates from the HSS and HIP surveys should continue. It may be possible to drop migratory bird harvest estimates from HSS once the HIP sampling frames and biases have been fully evaluated. However, HSS estimates for some populations or species, such as HLP Canada geese, must be continued for proper management.

Participation in Central Flyway Assignments

Methodology
The Central Flyway (CF) is an administrative unit for migratory bird management. It's comprised of ten states (Colorado, Kansas, Montana, Nebraska, New Mexico, North

Dakota, Oklahoma, South Dakota, Texas, and Wyoming), two Canadian Provinces (Alberta and Saskatchewan), the Northwest Territories and Nunivut. The Central Flyway Council (Council), established in 1948, is an advisory body to the USFWS and assists the CWS in matters regarding migratory birds. There are 3 technical committees that advise the Council and provide recommendations for potential actions. Inversely, the USFWS, CWS and other agencies use the CF to dispense information to the technical committees regarding species population status and other issues involving migratory birds.

The Central Flyway Waterfowl Technical Committee (CFTWC) meets 3 times a year to discuss management and other issues related to migratory game birds. The Central Flyway Webless Game Bird Technical Committee, which primarily deals with those species other than waterfowl (e.g. mourning doves, woodcock) meets once per year, with their meeting held in conjunction with the CFWTC. The Central Flyway Non-game Migratory Bird Technical Committee (CFNMBTC) was established in 2005, and primarily deals with non-game migratory bird issues. The CFNMBTC meets twice per year in conjunction with the CFWTC.

Various issues regarding the management of migratory birds are discussed within designated sub-committees within the 3 technical committees, and recommendations are then brought forth concerning potential action. The entire technical committee then votes on the recommendation, and if passed, forwards it to the Council for their discussion and vote. If the Council passes the recommendation, it is forwarded to the USFWS for their consideration for the upcoming season or regulation change. If the recommendation concerns issues that do not deal specifically with season regulations, for example, a letter to an entity that is degrading habitat, then the Council chairman drafts a letter and sends it to the entity.

The technical committees are also responsible for drafting management plans for waterfowl and other migratory bird populations. These management plans are typically written to identify specific populations, establish population and/or harvest objectives, and identify and prioritize research needs. The Council approves all management plans.

Necessity

Participation in CF activities is very valuable to the NGPC in making management or conservation decisions. Decisions made by the CF directly impact population objectives, harvest regulations and related management actions. Because of the wide range of issues that are discussed and the amount of information dispensed at the meetings and through CF contacts, the NGPC can make more informed and effective management decisions. Thus, our linkage with the CF is essential for proper management of the migratory bird resources in Nebraska. Additionally, the CF provides a forum in which Nebraska can propose changes in harvest regulations or other management and inventory actions that are pertinent to Nebraska.

Adequacy
The CF meetings are accomplishing the task of providing pertinent information and a forum for Nebraska to understand and propose changes in harvest regulations and other management/inventory actions. The meetings are well timed to initiate management action prior to hunting seasons and surveys.

Reliability
Decisions made at the Flyway level are considered to be in the best interests of the migratory bird resources within and outside the Flyway, and are typically based upon the best biological information available. Management actions also can be monitored by each state or province so as to not adversely affect that particular state or province's resources or hunting opportunities. The process exists to provide for changes to be made in a timely manner if enough biological evidence is brought forth before the technical committees and the Council. A review of the flyway system was conducted in 1995 by the International Association of Fish and Wildlife Agencies and it generally concluded that although modifications/improvements were necessary, the management of migratory game birds should be managed at some level along the flyway system (Wagner 1995).

Efficiency
Currently, the cost of gathering, dispensing and acting on information is small relative to the necessity and utility of the information. Although information can be supplied or disseminated via other means, discussion of certain items/topics has to be accomplished and is more productive in face-to-face meetings.

Conclusions and Recommendations
Participation in the Central Flyway should be continued. Almost all aspects of migratory bird management applicable to Nebraska are dealt within the Flyway, and discontinued participation would greatly affect management decisions in a negative way. Discontinued participation by the NGPC would also affect the ability of other states and provinces to properly manage migratory bird populations.

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FURBEARERS AND OTHER MAMMALS

Annual Fur Harvest Survey

Methodology
The fur harvest survey is conducted on an annual basis. This mail survey is sent to all Nebraska fur harvest permit buyers. In some years two mailings have been used, but during the last two years, a single mailing was used. Little difference occurred between the two mailings, allowing us to conclude that a single mailing was simpler, faster and just as reliable. Fur harvesters are asked to provide their estimates of harvest for each species. Questions on the county of take, method used, and other aspects of fur harvesting are included.

Starting in 1998 a database containing current names and addresses is used for the survey. Using "current year" data provides more reliable addresses, but results in a two-month delay, while permit books are being returned by vendors. Resulting surveys now go out in April, compared to March when "old" permit books were used.

Necessity
The fur harvest survey is an important part of the furbearer program. Harvest levels are partially indicative of population levels and also reflect interest by fur harvesters. The fur harvest survey has been used for more than fifty years to estimate the harvest of furbearers in Nebraska. Thus, these data provide valuable long-term harvest trends. Harvest and effort information are used as a basis for determining the effects of season changes, changes in species abundance, and trapper/hunter interest. This information is critical to making recommendations for future seasons and management efforts.

Adequacy
The response rate for the single mailing in 2005-06 was 17%. Low response rate has been a concern with this survey. Numerous attempts have been made to improve response rate with little effect. The collection of email addresses through our Internet based permit system will allow an efficient supplemental method for surveying nonresponders. Nonresponder bias was also estimated through a 2003 phone survey. The results indicate that active harvesters were 4.7 times more likely to respond to the survey than those that did not participate in the furharvest season. Nonresponder bias will be estimated by phone survey for the 2006-2007 survey and at least every 3 years thereafter. Memory bias also occurs when surveys of this type are conducted months after the close of a season. While bias can have significant effects on estimates, it is expensive and time consuming to estimate. One of the main objectives of this survey is to provide long-term estimates of harvest and effort. While bias occurs, we believe that it has been fairly consistent across years and therefore allows us to have a reasonable estimate of statewide harvest trends over time. In this regard, this survey is adequate.

Reliability
Aside from bias, which has been discussed, this survey is considered to be a reliable indicator of population trends for most species. Harvest estimates for bobcat are usually similar to the numbers of animals tagged as part of a mandatory carcass tag requirements. Harvest estimates are less reliable for species that have low fur value (e.g. opossum) and for those species for which a fur harvest permit is not required (coyote).

Efficiency
This survey is cost effective. It is the only source of valuable information on eleven furbearer species, and it is significantly less expensive than telephone surveys. The collection of email addresses through our Internet based permit system provides the possibility of using email surveys as a cost effective way to supplement the furharvest surveys.

Conclusions and Recommendations
We recommend the continuation of this survey. Name and address extraction from permit books should be done earlier if possible to reduce memory bias. It is recommended that a second mailing be used every 3-5 years to determine if bias occurs between mailings.

Annual Fur Buyer Survey

Methodology
The fur buyer survey is conducted on an annual basis. This mail survey is sent to all Nebraska fur buyer permit holders. Fur buyers are asked to provide the number of furbearers of each species that they purchased as well as the average price paid. This information is also separated to determine the average price paid for pelts on the carcass and the average price paid for pelts that have already been skinned.

Necessity
The fur buyer survey is an important part of the furbearer program. Harvest levels are partially indicative of population levels and also reflect interest by fur harvesters. The fur buyer survey allows the detection of changes in pelt prices that effect interest and harvest effort. These data provide the ability to control for changes in pelts prices and thus harvest effort in order to interpret harvest data. This information is critical to making recommendations for future seasons and management efforts.

Adequacy
The response rate for the single mailing last year was 40%. Fur buyers are required to keep accurate electronic records and we believe the results of the survey provide an accurate representation of the prices paid in Nebraska. While

bias occurs, we believe that it has been fairly consistent across years and therefore allows us to have a reasonable estimate of statewide pelt prices over time. In this regard, this survey is adequate.

Reliability
We believe this survey provides data that is accurate. The pelt prices reported by Nebraska fur buyers are consistent with national averages for pelt prices during the same time frame.

Efficiency
This survey is cost effective. It is the only source of valuable information on pelt prices for the eleven furbearer species. Due to the low number of fur buyers and the large amount of data contained in their records, this survey is comparatively inexpensive and very efficient.

Conclusions and Recommendations
We recommend the continuation of this survey. The survey is an efficient method of determining average pelt prices paid to fur harvesters and thus changes in harvest effort.

Mink Population Status Survey

Methodology
Mink skulls were collected by cooperating fur buyers and trappers for each year during the period 1990-1997. Fur buyers collected and separated skulls by sex. Examination of the pulp cavity width of the canine teeth was used for age determination. Reproductive rates were generated by estimating the number of juveniles per adult female.

Necessity
When large changes in mink numbers are observed or suspected, this survey provides important additional information regarding vital rates beyond the capacity of the annual fur harvest survey. Age and gender data can be used to evaluate population structure and to test hypotheses regarding population change. However, when populations are apparently stable these data are less necessary. For this reason, the survey has not been run in recent years.

Adequacy
Estimates of recruitment rates can be generated from age and gender data. Data from 1990-1997 were adequate to indicate a stable mink population in Nebraska.

Reliability
Sample size has varied significantly throughout the years during which this survey has been conducted. One incidence of a reported high recruitment rate was attributed to a low sample size (in 1995/96). This survey has been analyzed

on a statewide basis because, although district goals were set for mink skull collections, limited or no information was available on some localities where mink were harvested. Regional differences in harvest intensity, prey abundance, and weather conditions are bound to result in variations between mink populations in different regions. In addition, differences in vulnerability to harvest may lead to biased samples. Nevertheless, mink age and gender analysis is an appropriate tool for determining trends in mink reproductive rates. Given adequate sample size and geographic distribution, trends in reproductive rates can be determined accurately.

Efficiency
Mink skulls can be collected from participating fur buyers with relatively little effort and cost. Pulp cavity width measurements and age determination are also inexpensive. A large number of samples can be processed in a short time.

Conclusions and Recommendations
I recommend the continuation of this survey if sufficient samples can be obtained and if fur harvest or other data suggest drastic changes in mink populations. Modifications to the survey should include the collection of area specific information (at least county) on harvested specimens and threshold sample sizes for each area. These modifications should allow for a more meaningful evaluation of trends in mink populations between and within regions in Nebraska.

Bobcat harvest/population assessment

Methodology
The US Fish and Wildlife Service requires that all bobcats harvested in the USA be tagged with federal carcass tags. This tagging requirement allows for more accurate harvest assessment of bobcats than for most other furbearing species. Over the past decade the number of bobcats harvested has consistently increased and the species has gained in popularity among trappers and hunters. Each year, information is collected for every bobcat harvested (date, county, gender, method of take) and bobcat harvester (name and address). The data are recorded when the animal is submitted for tagging.

Necessity
The bobcat harvest has increased steadily over the past decade. Accurate harvest records, in conjunction with unit-effort-measures, can be utilized to index changes in population densities. This index, and the finding that population changes are not homogeneously distributed across the State, aid in the development of management strategies, such as season recommendations.

The retrieval of accurate absolute harvest numbers for a furbearing species such as the bobcat is not only an excellent source of data for harvest and population assessment for that particular species, but also invaluable for comparing the

tagging results with the results from the annual fur harvest survey. Such comparison can yield an estimate of the divergence between actual harvest numbers and harvest numbers estimated from the survey.

Adequacy

This survey provides important information on bobcat harvest and population trends. It is adequate both for detecting regional differences in harvest intensity and success, and for population-related information essential to forming management recommendations.

Reliability

For no other furbearing species are such accurate absolute harvest numbers available as for the bobcat. However, harvest numbers, no matter how accurate, should always be used cautiously because of the obvious biases resulting from changing factors such as market value and weather conditions. Including harvest effort into the calculation of indices can minimize the effect of some of these biases.

Efficiency

The survey efficiently measures the harvest of, and yields a population index for, bobcats in Nebraska. It is done in conjunction with and based on the results of the federally required carcass tagging and does not incur a significant additional cost.

Conclusion and Recommendations

We recommend the continuation of this survey. Minor modification to the information collected and the possibility of re-starting the cementum annuli aging procedure for a sub-sample of the harvest may be considered for future surveys. We also recommend the possible incorporation of reproductive history monitoring in a sub-sample of females for the purpose of determining reproductive rate and success.

NATURAL HERITAGE PROGRAM SPECIES

Mountain Plover Nesting Survey

Methodology

The survey method for mountain plover has varied, but has generally consisted of sequential survey periods designed to detect species presence and habitat use during spring migration, nesting, and brood rearing. In recent years, monitoring has been done collaboratively with University of Nebraska-Lincoln and Rocky Mountain Bird Observatory. These surveys have been more intense than earlier ones and have collected information on nest numbers and nest survival. The first surveys begin in early April. The second phase is conducted during May and consists of road surveys of potential nesting sites, walk-in inspections, and surveys with all-terrain vehicles. On-ground surveys are conducted with landowner permission. Data are collected on plover location, numbers, nest numbers, nest survival, habitat, surrounding land use, and identified and potential threats. Data on mountain plover occurrences are then entered into the Biological Conservation Database (BCD) maintained by the Natural Heritage Program of the NGPC.

Necessity

The mountain plover is listed as threatened in Nebraska and is a candidate for federal listing. As a listed species, State law requires that the NGPC conduct reviews and consult on projects that may have an impact on this species. This requires information on the current status of the species based on occurrences and habitat use. This information is also essential for monitoring the numbers and distribution in the state, and in the development and implementation of conservation actions.

Adequacy

Recent research and survey work has greatly improved our knowledge regarding the species' occurrence in the state. The mountain plover is very difficult to observe when nesting and it is even more difficult to track the movement of adults and young to brooding sites. Logistics make these types of data collection very time intensive. Currently, different survey methods (e.g. patch occupancy, double-observer, and concurrent use of both) are being developed by various workers to find an effective and efficient way to survey this species. Furthermore, surveys in Nebraska only provide information from a small portion of the species' overall range. Fluctuations in numbers, or even a detected trend, in Nebraska has limited value because this may simply reflect immigration/emigration from other breeding areas rather than an overall population increase or decrease.

Reliability

The survey data are reliable in as far as they indicate site use by migrating and nesting individuals within Nebraska and provides limited nesting information. These data fulfill the primary survey objectives.

Efficiency

Current surveys and research have yielded considerable information, however this has come with a significant burden on personnel time and budgets. A basic survey of plover numbers may be more cost effective with occasional work on nest and chick survival to determine whether mountain plovers are compatible with evolving land-use practices.

Conclusions and Recommendations

As conducted to date, the mountain plover survey has collected important data to meet identified needs. Data needs for the species continue to evolve due to the potential listing of the species as federally threatened, the species' use of agricultural fields for nesting, intensive management practices conducted to protect nests in agricultural fields, and increased knowledge of the species distribution within Nebraska. Currently there is some discussion among states to develop a range-wide mountain plover survey and we are in support of that proposal. Until such a survey is implemented, we will continue mountain plover surveys in Nebraska. Because the situation is complex and plovers are nesting in human-constructed habitats, the survey should be expanded to determine nest survival, chick survival, and causes of mortality. A central question in mountain plover conservation is whether the species' nesting and reproduction is compatible with agriculture. Nest success does not appear to be a major contributor to recruitment or population growth (Victoria Dreitz, Colorado Division of Wildlife, and Stephen J. Dinsmore, Iowa State University, personal communications). Moreover, nest survival has been relatively high (>40%) in active agricultural fields (Dreitz 2004). Thus other variables may be causing perceived declines. The collection of additional survival parameters will elucidate reasons for declines but will require the commitment of greater personnel and financial resources. However, because mountain plover nest and chick survival is directly associated with precipitation, there is a need to develop surveys across the range of the species so that data are not confounded by localized weather events. Thus, there is a need to further cooperate with other states on these projects.

Literature Cited

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Whooping Crane Migration Survey

Methodology

The Nebraska Whooping Crane Migration Survey is conducted in conjunction with the Cooperative Whooping Crane Tracking Project, a survey coordinated by the U.S. Dept. of the Interior, Fish and Wildlife Service, Ecological Services, Nebraska Field Office in Grand Island, Nebraska. Martha Tacha serves as the flyway coordinator. Survey protocol follows guidelines recommended by the Whooping Crane Recovery Team and those outlined in the following: *U.S. Fish and Wildlife Service. 1986. Whooping Crane Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. vi + 283 pp.*

As specified in the "Guidelines for Preparation of Evaluation Reports for Survey and Inventory Projects" the above reference for this cooperative survey will suffice and further evaluation is not required.

Least Tern and Piping Plover Nesting Survey

Methodology

Surveys to locate nesting colonies, to census adults, and to count nests are conducted from April to August, while follow-up visits to assess productivity occur from June to August. River sandbar and reservoir colonies are surveyed by boat while colonies at sandpits adjacent to the river are surveyed on foot. Surveys are conducted annually along the Platte River and intermittently on the Niobrara, Loup and Elkhorn Rivers. Survey protocol has been developed by us and other experts with guidance from the Piping Plover Recovery Team (now disbanded). Survey protocol has been continually evaluated and updated. Survey protocol follows guidelines recommended by the *Great Lakes and Northern Great Plains Piping Plover Recovery Plan*. Surveys also follow protocols established for the International Piping Plover Census, the Missouri River Least Tern and Piping Plover Monitoring Program and protocols being established for the Tri-State Platte River Cooperative Agreement.

Necessity

Nebraska's state laws require the NGPC to establish and carry out programs (i.e. Least Tern and Piping Plover Nest Monitoring) that are necessary for the conservation of endangered and threatened wildlife. State law also requires this agency to carry out consultations that will insure that State actions do not jeopardize the continued existence of such threatened or endangered species or result in the destruction or modification of their habitat. Information collected on least tern and piping plover nesting activity is essential to the database used to evaluate project impacts, assess population status, and to formulate management priorities that will assist recovery and subsequently allow for the removal of these species from the endangered species list.

Adequacy

The *Great Lakes and Northern Great Plains Piping Plover Recovery Plan* and the *Interior Population of the Least Tern Recovery Plan* identifies recovery goals for the region. Recovery goals address protecting and managing essential habitat and increasing and maintaining populations. Adequate population data are collected to determine trends at several scales, including at the colony, habitat type, river reach, river system, statewide and international scales. Adequate productivity data are collected and analyzed to quantify and evaluate breeding habitat, to identify and evaluate threats, and to assess management activities. The information collected is adequate for decision makers to assess impacts of proposed development activities and also allows for the evaluation of the recovery status of the species.

Reliability

Declining piping plover populations (and to a lesser degree least tern populations) have attracted national and international attention. Considerable effort has been expended over the years developing reliable survey methods and standardizing data collection for accurately estimating numbers and measuring productivity.

Efficiency

Data are being collected in a cost efficient manner. Instead of repeated visits to nesting colonies we currently time our surveys to coincide with two periods of activity. Breeding population surveys are timed to occur at the peak of incubation, this being dependent on river flow conditions and the availability of habitat. Data are collected on the number of adults, the number of nests, incubation stage, and in some instances, site characteristics and potential disturbances. Incubation stage data collected on the first survey help define the timing of the follow-up survey to estimate reproductive success. Data on the number of young (fledged or other), re-nesting efforts and disturbances are collected on this second visit. Surveys of sandbar and sandpit habitats are run concurrently to avoid double counting birds. The ground survey crew assists the airboat survey crew by providing fuel and other needs as both surveys progress down the river.

Conclusions and Recommendations

Least tern and piping plover populations fluctuate and numbers have generally been below recovery levels. Productivity in many cases is also below levels needed to sustain or increase populations. Developments that threaten riverine habitat continue to be proposed, however, efforts to restore populations through habitat protection and restoration are increasing. Survey efforts should continue, and the current survey protocol should be maintained. However, development of survey methods that account for detection probability will provide more reliable estimates.

Bald Eagle Midwinter Survey

Methodology

The Nebraska Midwinter Bald Eagle Survey is conducted in conjunction with the National Midwinter Bald Eagle Survey, a cooperative survey coordinated by the U. S. Dept. of the Interior, United States Geological Survey, Forest and Rangeland Ecosystem Science Center, Snake River Field Station in Boise, Idaho. Karen Steenhof serves as the National Coordinator. Survey protocol follows that outlined in the following: *U.S. Fish & Wildlife Service. 1983. Northern States Bald Eagle Recovery Plan. 76pp*.

As specified in the “Guidelines for Preparation of Evaluation Reports for Survey and Inventory Projects” the above cited reference for this cooperative survey will suffice and further evaluation is not required.

Bald Eagle Nesting Survey

Methodology

Several site visits are made to all known bald eagle nests in March/April to determine occupancy. Nests are observed primarily from the ground although some inaccessible sites are surveyed by boat or aircraft. Follow-up visits are made to all occupied nests to monitor nesting activities and to determine productivity. Survey protocol follows that outlined in the *U.S. Fish & Wildlife Service. 1983. Northern States Bald Eagle Recovery Plan. 76pp*. Survey protocol is further described in the NGPC's *Bald Eagle Nest Monitoring, Survey Summary*.

Necessity

Nebraska's state laws require the NGPC to establish and carry out programs (e.g. Bald Eagle Nest Monitoring) that are necessary for the conservation of endangered and threatened wildlife. State law also requires this agency to carry out consultations that will insure that State actions do not jeopardize the continued existence of such threatened species or result in the destruction or modification of their habitat. Information collected on bald eagle nesting activity is essential to the database used to evaluate project impacts, assess population status, and to formulate management priorities that will assist recovery and subsequently allow for the removal of the bald eagle from the endangered species list.

Adequacy

The *Northern States Bald Eagle Recovery Plan* identifies recovery goals for the region. Identified recovery goals for nesting eagles in Nebraska include 10 pairs of nesting eagles by the year 2000, and those nests maintaining an average annual productivity of at least 1.0 young per occupied nest. Adequate information is collected on nest location, breeding occurrence, population size, and nest production for decision makers to assess the impacts of proposed development activities and to evaluate the recovery status of the species.

Reliability

In the past, low numbers of nesting bald eagles in Nebraska made monitoring every nest relatively cost-effective. Multiple visits to each site have provided accurate and reliable measurements of reproductive output. However, active nest numbers continue to increase and collecting information on every nest is challenging. Despite this, detailed data collected from current and past nest monitoring creates an excellent foundation to build more efficient, less intensive, surveys while still maintaining survey quality.

Efficiency

Data are being collected in a cost efficient manner. With a better understanding of the chronology of bald eagle nesting in Nebraska, we have been able to direct our field staff to conduct site visits at more critical times (i.e. instead of visits every two weeks, we recommend a site visit in March/April to determine occupancy, Mid-May to determine hatching success, and June to determine productivity). This has resulted in fewer site visits but has improved the quality of information collected. In areas where several nesting sites occur (e.g. Missouri River), we have cooperated with a neighboring state in using a fixed-wing aircraft to determine territory occupancy.

Conclusions and Recommendations

In Nebraska, territories occupied by nesting pairs of eagles have increased from 1 in 1991 to 45 in 2006. A total of 432 bald eagle young were fledged from the 247 nesting attempts with know outcomes since breeding was first documented in 1991. The average annual reproductive rate of 1.6 young fledged/occupied site is above the rate of 1.0 young fledged/occupied site needed for recovery. Based on the results of our surveys, Nebraska is supporting the current, federal proposal to delist the bald eagle. However, as suggested by the USFWS, nesting surveys and monitoring efforts are planned to continue for the next five years following delisting. Current survey efforts and protocol will, for the most part, be maintained. However, there is a need to evolve survey protocol as nest numbers continue to increase. This evolution may involve the development of a dual-frame sampling design that has been used elsewhere to monitor eagle breeding (Haines and Pollock 1998).

Literature Cited

Haines, D.E., and K.H. Pollock. 1998. Estimating the number of active and successful bald eagle nests: an application of the dual frame method. Earth and environmental statistics.

Prairie Dog Status Survey

Methodology

Aerial photographs at USDA Farm Service Agency county offices were inspected for evidence of prairie dog colonies. Size and location of prairie dog colonies were recorded along with landowner information for contact purposes. Colonies identified from aerial photos were then verified on the ground either by observations from the road or, when landowner permission was obtained, colonies were ground-surveyed using GPS to obtain exact colony location and size data according to standardized protocol guidelines. New colonies not identified from aerial photos were also recorded. Colonies were surveyed for level of active use, evidence of control activities, evidence of plague, and associated species. Data from the survey were used in a regression analysis to obtain estimates of the total acreage and number of colonies in each of the counties surveyed.

Necessity

In 2000 the black-tailed prairie dog (BTPD) was designated a federal candidate for listing as threatened. Eleven states within the historic range of the species entered into a memorandum of understanding to participate in a Conservation and Assessment Strategy to develop and coordinate range-wide conservation efforts. As with most states, complete and accurate data were lacking on the distribution and status of the species in Nebraska, and the total acres of BTPD colonies were not known. Due to the potential listing of the BTPD there was a need to undertake a statewide survey to determine the baseline number of acres and distribution of BTPD in Nebraska. This information was intended for use in the multi-state conservation effort and for the

development of a state conservation plan for the species. Although the USFWS determined that federal threatened status was not warranted in 2004, the states still have a need to reliably monitor this keystone shortgrass prairie species.

Adequacy

While the survey method did provide useful data as to the occurrence of recent colony locations, its results were limited by several factors. The estimates derived from the survey did not provide the accuracy and geographic coverage to act as an effective, statewide survey method that could provide statistically repeatable results with confidence intervals. Such a method is needed in order to obtain results that can serve as a baseline and allow unbiased comparisons over multiple years to assess changes in prairie dog colony distribution and ground coverage. As conservation planning efforts progress, the need for additional data will also require an expansion in survey effort and a more extensive design. Added survey needs include: (1) DNA testing to determine any genetic differences between colonies within Nebraska and across the species' range, (2) systematic testing of colonies, associated mammals, and predators for plague, and (3) the use of GIS to evaluate and identify potential prairie dog habitat, determine complex size, and plan for colony and complex expansion. Long-term monitoring will also be needed to track population trends and gauge the effects of conservation plan implementation, control activities, and plague outbreaks.

Reliability

The identification of active colonies from the remote sensing data available at the time was problematic. Aerial photographs, color slides, and satellite images can indicate the presence of many but not all prairie dog colonies. Additionally, in most cases the imagery was 6-7 years old and in the interim there were significant changes in some colonies due to expansion, control actions, land conversion, or the formation of new colonies. In order to tell if a colony is active it is necessary to conduct a ground survey of the site. Ground verification is extremely labor intensive and is virtually impossible since a significant number of landowners will not allow access. This resulted in an inability to verify town status and size and precluded detecting many new colonies.

Efficiency

The use of a survey method based on this type of data collection over as large a geographic area as that occupied by the black-tailed prairie dog is time consuming and expensive. Survey methods used need to be as cost effective as possible while still obtaining data with the necessary level of detail.

Conclusion and Recommendations

For this period, the BTPD survey using FSA aerial photos did provide valuable but limited data on the occurrence and distribution of BTPD in Nebraska. It did not however, meet the overall need to establish a baseline from which repeatable monitoring could be conducted. Subsequent to this survey effort, the Commission conducted an aerial survey in 2003 to estimate the area occupied by black-tailed prairie dogs within the major portion of the species' current range in Nebraska. The survey methodology was based on line intercept method used by the Colorado Division of Wildlife in 2002. The

survey area included 40 counties (whole and partial) and more than 22 million acres. This repeatable survey method provided statistically verifiable results with confidence intervals that can serve as a baseline for future survey efforts.

Although a standardized, range-wide protocol has not yet been developed, a target of statewide monitoring every three to five years has been established by the interstate conservation group. Since the initial survey, new satellite imagery may provide the resolution necessary determine size, identify active colonies, and provide up-to-date imagery. Survey efforts from other states have provided several methods that are efficient and cost effective. The Commission will review and evaluate these methods when considering the survey design for the next survey, which is tentatively scheduled for 2008.

Maintenance and Updating of the Nebraska Natural Heritage Database: Birds, Mammals, and Natural Communities

Methodology

Information about the status and distribution of threatened and endangered species, rare species, natural communities, and other unique ecological features in Nebraska is collected and stored in a centralized data management system. Data are entered on map, manual, and computer files and are compiled and made easily accessible for report preparation using a relational database. Records are indexed by several criteria including standardized name, location, state and federal protection status, state ranks, watershed, and land ownership. Data are queried and spatially represented using a geographic information system (GIS).

Data are compiled, queried, and spatially represented on rare, threatened and endangered bird and mammal species through various methods including:

a) Review of the scientific literature for documented occurrences of species of concern in Nebraska;
b) Review of pertinent museum collections for occurrences of species on the animal occurrence list;
c) Data dissemination and entry of pertinent information collected by other natural resource and land management agencies;
d) Participation in or sponsorship of volunteer survey efforts and subsequent data dissemination and entry into the database;
e) Contracted surveys by qualified groups or individuals to document occurrences of species included on the animal occurrence list or to evaluate the ecological importance of unique natural habitat communities; and
f) Library references on element species, field survey reports, and correspondence files with various pertinent state and regional species experts.

Maintenance and updating of the bird, mammal, and natural community portions of the Nebraska Natural Heritage Database follows a rigorous and standardized protocol to

ensure continued program utility and integration among the relational database; map, manual, and computerized files; and the GIS.

Necessity

Nongame and Endangered Species Conservation Act (NESCA)—Threatened and Endangered Species Consultation Provisions: Provisions of the State Nongame and Endangered Species Conservation Act require that State agencies consult with the Commission to ensure that projects and proposals funded and permitted do not have impacts to State threatened and endangered species. NGPC staff rely heavily on the Nebraska Natural Heritage Database to complete these reviews. Thus, the continued maintenance and updating of the bird, mammal, and natural community portions of the Nebraska Natural Heritage Database are essential to ensure that consultations completed by staff are based on current information.

National Environmental Policy Act (NEPA)—Environmental Review: The Commission regularly responds to requests to review NEPA documents. These documents include Environmental Impact Statements and Environmental Assessments, decision documents about categorical exclusions, and Findings of No Significant Impacts. Commission staff rely on the Nebraska Natural Heritage Database to complete reviews of these documents. Continued maintenance and updating of the bird, mammal, and natural community portions of the Nebraska Natural Heritage Database are essential to ensure that reviews of NEPA documents are completed by staff using current information.

Clean Water Act Section 404 reviews for Individual Permits: The Commission regularly reviews Section 404 Clean Water Act Individual Permits. Commission staff rely on the Nebraska Natural Heritage Database to complete these reviews. Continued maintenance and updating of the bird, mammal, and natural community portions of the Nebraska Natural Heritage Database are essential to ensure that Section 404 Individual permits are reviewed by staff using current information.

State and Federal Agencies, and Private Consultant Data Requests: State and federal agencies and private consultants regularly request reports and maps showing the distribution of birds, mammals, and natural communities in Nebraska. Commission staff rely heavily on the relational and GIS databases to respond to these requests. Continued maintenance and updating of the bird, mammal, and natural community portions of the Nebraska Natural Heritage Database are essential to ensure that reports and maps generated for outside agencies and consultants by staff are completed using current information.

Land Protection: Information from the Nebraska Natural Heritage Database focuses attention on the State's most critically imperiled wildlife and their habitats. Commission staff rely on the relational and GIS database to assign priorities, allocate resources, and make state listing decisions to protect critically imperiled birds and mammals. Continued maintenance and updating of the bird, mammal, and natural community portions of the Nebraska Natural Heritage Database are essential to ensure decisions made by staff are based on current information.

Resource Management: Information from the Nebraska Natural Heritage Database is used by managers when making land management decisions. Continued maintenance and updating of the bird, mammal, and natural community portions of the Nebraska Natural Heritage Database are essential to ensure decisions made by land managers are based on current information.

Adequacy

Staff have successfully integrated GIS with the Heritage Database to represent the distributions of birds, mammals, and natural communities in Nebraska. Integration improves the efficiency of NESCA Consultation, NEPA document reviews, and Section 404 reviews. Integration also provides staff with the ability to query and spatially represent datasets on distribution maps when completing data requests for state and federal agencies and private consultants. Heritage/GIS integration provides broad distribution maps for birds, mammals, and natural communities especially useful in making decisions about assigning protection priorities, resource allocation, and strategies for land management. As software becomes available, staff will integrate GIS and the Heritage Database completely.

Reliability

The Nebraska Natural Heritage Database adheres to standard protocols for entering, updating, and organizing data about birds, mammals, and natural communities. Data are subject to two levels of quality control: (1) prior to entry into the database and (2) following database entry. Data collected about birds, mammals, and natural communities must meet certain criteria to be entered into the Heritage Database.

Efficiency

Integration of GIS with the Heritage Database has made access to and maintenance of bird, mammal, and natural community data efficient. A gap exists between the time data are collected and their entry into the Heritage database. Although probably inherent to the system, the gap could be reduced by utilizing electronic means for data collection and entry into the database.

Conclusions and Recommendations

Integration of GIS and the Nebraska Heritage Database has been an important component ensuring that bird, mammal, and natural community data are efficiently maintained and updated. Staff rely on current data to complete consultations under NESCA provisions, NEPA reviews, and Section 404 reviews; provide data products to state, federal, and private consultants; set protection priorities and allocate resources;

and make land management decisions. Recommendations include continued exploration and use of available software/hardware to completely integrate GIS with the Heritage Database and to reduce the time gap between data collection and entry into the database. This project will continue, but funding may come from sources other than that available under the Federal Aid in Wildlife Restoration Act.

WILDLIFE MORTALITY, DISEASE AND PARASITE INVESTIGATIONS

Background and Need

Disease and parasites can impact wildlife in numerous ways. The onset of fowl cholera or botulism can rapidly kill hundreds of thousands of birds, often over 1,000 per day. Other diseases, such as meningeal worm or chronic wasting disease may initially affect a single animal but have the potential of spreading to entire populations. The effort to track the occurrence of these mortality agents, the control (when possible) of outbreaks, and the continued gaining of knowledge regarding these agents and the animals they affect are all necessary activities to insure that wildlife resources are not negatively impacted by uncontrolled disease or parasite outbreaks. Opportunities for human recreational pursuits involving wildlife can be curtailed by the mortality of animals, the transmission of certain disease agents from wildlife to commercially produced livestock can devastate agriculture economies, and the rare transmission of diseases (e.g., West Nile Virus) and/or parasites from wildlife to humans can have catastrophic effects on individuals and families. Informational needs regarding wildlife and disease/parasite interactions include: (1) the frequency and location of disease/parasite infections in wild populations, (2) effective measures that can be taken to control and/or prevent outbreaks of disease/parasite agents, and (3) updates on new diseases/parasites, their biology, and their control as these features relate to wildlife populations.

Additionally, with the onset of large game ranching enterprises, the continued demand by the general public for permission to keep exotic pets, and the movement of exotic and commercial animals through the State, the danger of introducing new and exotic diseases/parasites to Nebraska's wildlife is ever present. These new agents have the potential to negatively impact native wildlife to the point of decimating populations; chronic wasting disease in cervids is of particular concern in this regard. The continued search for knowledge on various emerging disease issues in necessary in order to protect our natural resources.

Methodology

General

Procedures to develop and maintain information on diseases/parasites that occur in Nebraska's wildlife include: (1) field reports of known occurrences of disease/parasite infections in wild animals, (2) laboratory analysis of carcasses or parts of carcasses to determine agents causing mortality, (3) clean-up actions to prevent the continued spread and/or occurrence of disease events, (4) maintenance of files in the Lincoln office tracking disease/parasite occurrence, and (5) continued review of literature to keep informed regarding new diseases/parasites and the management of new and known diseases/parasites.

Chronic Wasting Disease (CWD)

Biologists working deer check stations are instructed on the removal of retropharyngeal lymph nodes. During the firearm deer season hunters are asked to voluntarily submit

their deer for testing. Deer exhibiting clinical symptoms are also collected for testing. Samples are sent to University of Nebraska – Lincoln diagnostic laboratory and screened using the enzyme-linked immunosorbent assay (ELISA) test and confirmed by the Wyoming State Veterinary laboratory using immunohistochemistry (IHC). Hunters whose deer test positive are notified by phone. In 2006 a total of 5,833 deer was tested and 18 confirmed positive for CWD. A total of 115 free ranging deer have tested positive since testing began in 1997.

Adequacy

The current protocol for reporting and evaluating disease/parasite occurrences in Nebraska is being reviewed and a new manual for field use will be developed during the next two years. The basic information is currently kept in file cabinets in the Lincoln office and plans are to develop a computer-based database to provide easier access to information from field locations. The procedures currently used for reporting disease/parasite-infected animals insure that the Lincoln office is informed of mortalities and they allow for quick referencing on-site by Lincoln-based staff. Specimen collection, preservation and shipping protocols follow those recommended by the National Wildlife Health Laboratory, and all questionable occurrences are submitted to either the Veterinary Laboratory at the University of Nebraska, Lincoln; the National Wildlife Health Laboratory in Madison, Wisconsin; the Nebraska Department of Agriculture approved Veterinary Laboratories in several locations in Nebraska; or the National Veterinary Services Laboratory in Ames, Iowa. Disease control operations are conducted according to guidelines provided by the National Wildlife Health Laboratory. Data collected are used to evaluate needed regulatory changes for the maintenance of wildlife health, determine potential problem areas for disease/parasite outbreaks, and identify materials needed by field location to address disease/parasite occurrences.

Reliability

The use of approved laboratories for specimen analysis insures that proper diagnoses are made. The use of nationally recognized and accepted protocols for specimen collection, preservation, and shipping as well as the use of nationally recognized and accepted protocols for disease control operations insures that actions taken by the NGPC will be successful in addressing the needs on the ground when disease/parasite outbreaks occur.

Efficiency

With the dissemination of information on the proper methodologies to collect, preserve and ship specimens, and the adoption of nationally accepted disease control procedures, the efficiency of the attempts to control and prevent disease/parasite outbreaks has improved greatly. The maintenance of a database for these occurrences provides an efficient manner in which to evaluate repeated occurrences and address management needs to prevent and/or reduce these events.

Impacts to Listed, Proposed, or Candidate Species

The only impact to listed, proposed or candidate species by the collection of specimens of diseased/parasite impacted animals would occur if the animal in question was a

listed, proposed or candidate species. If this occurs, the USFWS will be consulted prior to the actual taking of a live specimen for testing. In the event one of these species is found dead, the USFWS will be contacted for a decision on how to proceed with the evaluation of the event. In the event that a large die-off/disease occurrence in the population of one of these species, or if an event in another species has the potential to spread to a listed, proposed or candidate species, consultation with the USFWS will insure that proper procedures are followed.

Conclusions and Recommendations

With the ever-increasing utilization of wild places by human populations, the increasing development of captive wildlife farming operations, and the increased interest in exotic pets, the continued tracking and evaluation of wildlife diseases/parasites is imperative if we are to protect native species and maintain viable populations of all wildlife. The high potential for contact between the general public and wildlife requires that wildlife agencies stay abreast of any potential disease/parasite that may be transmitted to humans. In an agricultural state like Nebraska, the potential for the transmission of disease/parasite agents between livestock and wildlife must be monitored to insure that wild populations are not sacrificed or that wildlife is not inappropriately blamed for disease/parasite outbreaks in domestic livestock.

This project should continue to insure that disease/parasite mortality events are documented and evaluated to protect the health of Nebraska's native animals and to prevent the transmission, if possible, of diseases/parasites from wildlife to humans, wildlife to domestic livestock, or domestic livestock to wildlife. Continuing and emerging disease issues such as West Nile Virus (93 positive domestic and wild animals detected in Nebraska in 2006), highly pathogenic avian influenza, diseases in illegally introduced feral hogs [pseudorabies and porcine reproductive and respiratory syndrome (PRRS) were both recently detected in animals collected by NGPC staff], epizootic hemorrhagic disease, and CWD will all need coordinated monitoring and response in the coming years.